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Intelligent Cutting Head BLT510 Product Manual

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Foreword

Thank you for choosing the BLT intelligent cutting head. This manual provides you with important information such as product parameters, installation, and maintenance. Please read this manual carefully before using the product. At the same time, to ensure both operational safety and optimal product performance, please carefully adhere to the precautions outlined in this manual.

BOCHU is constantly updating/upgrading products, so our company reserves the right to modify the product models and descriptions in this manual without prior declaration.

If you have any questions or suggestions during use, please contact us using the information provided in this manual.

Symbol Definitions

Notice: Provides supplementary explanations or clarifications for the product.

Caution: Indicates that non-compliance with the instructions may result in minor injuries or equipment damage.

Warning: Indicates that non-compliance with the instructions may result in severe injuries or death.

Danger: Indicates that non-compliance with the instructions will result in severe injuries or death.

Declaration

Disassembly of the product is strictly prohibited without the technical authorization from BOCHU, otherwise the warranty will be invalid!



Revision History

Version No.	Date	Description
V1.1.0	2024/08/23	First English version.
V1.1.1	2025/04/17	Format and content revision



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Chapter 1 Product Specification

1.1 **Product View**



Figure 1-1 Product view

- 1. Fiber Optic Interface;
- 2. 1st Upper Protective Window Cartridge;
- 3. 2nd Upper Protective Window Cartridge;
- 4. Collimation Unit;
- 5. Focusing Unit;
- 6. 2nd Lower Protective Window Cartridge;
- 7. 1st Lower Protective Window Cartridge;
- 8. Work Indicator Light;

- 9. Cutting Gas Interface;
- 10. Reflection Module;
- 11. Cooling Water Outlet;
- 12. Cooling Water Inlet;
- 13. Protective Screws;
- 14. Ceramic Body Lock Ring;
- 15. Ceramic Body;
- 16. Nozzle.



1.2 Technical Parameters

Parameters	Values		
Laser Wavelength	1030 ~ 1090 nm		
Laser Power	\leq 4 kW		
Fiber Interface	QBH, EOC		
Spot Magnification	M = 1.5/2.0/2.5		
Max. Focus Adjustment Range	M = 1.5 (-20 mm, +35 mm); M = 2.0 (-40 mm, +40mm); M = 2.5 (-50 mm, +50mm)		
NA	Max.0.13 at Fc100		
Centering Adjustment Range	±1.5 mm		
Focusing Acceleration	7.5 m/s ²		
Cutting Gas Interface	ø10, max 25 bar (2.5 MPa)		
Water Cooling Interface	ø8, max 5 bar (0.5 MPa), min flow 2.0 L/min		
Working Temperature	5 ~ 55°C (41 ~ 131°F)		
Storage Temperature	-25 ~ +55°C (-13 ~ +131°F)		
Dimension	409 mm x 299 mm (QBH-200J)		
Weight	About 6.5 kg (QBH-200J)		

To avoid the damage of cutting head during storage or transportation, the following shall be taken into consideration:

A Caution:

1. The cutting head should be stored in the environment within the allowed temperature and humidity range.

2. Avoid storing in magnetic fields (such as permanent magnets or strong alternating fields) and their vicinity.

3. Avoid collisions during transportation or usage.



1.3 LED Indicators

Icon	Status	Indication
POWER	Green	The power is normal.
	Red	Under-voltage alarm due to insufficient electrical power.
I I	Light off	Power off. The cause might be that no power is on; the connecting wires are damaged or malfunctioning; the interface is loose.
RUN	Green	The system is normal.
₽	Red	Motor exception. The motor current consumption is too high, and the mechanical components cannot operate smoothly.
TT	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.
LINK	Green	The communication is normal.
	Red	Communication exception.
•	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.
SENSOR	Green	The readings of each sensor are normal.
	Red	There are exceptions in the sensors' readings.
ĮĮ	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.



Chapter 2 Gas Interface



Figure 2-1 Cutting gas interface

A Caution:

1. The quality of cutting gas should meet the requirements of ISO 8573-1:2010: solid particles - class 2, water - class 4, oil - class 3. The purer the cutting gas, the longer the service life of the protective window.

2. The maximum pressure of cutting gas is 25 bar (2.5 Mpa).

3. The cutting gas pipe diameter (outer diameter) is 10 mm.

Chapter 3 Water Cooling Interfaces



Figure 3-1 Cooling water interfaces

A Caution:

1. Use purified water for the cooling water; purified drinking water is adoptable.

2. To prevent the pipeline blockage caused by mold growth in the water of the water cooler, it is recommended to add alcohol (CH3CH2OH) to purified water with an alcohol content of 10% of the purified water.

3. When the temperature around the device is between $-10 \sim 0^{\circ}$ C, a 30% ethylene glycol solution must be used and replaced every two months.

4. When the temperature around the device is below -10°C, a water cooler machine with a dual functioning system must be used, and the cooling system must operate continuously.

5. Recommended settings for cooling water: cooling water pressure \leq 5 bar (0.5 MPa), water flow



rate \geq 2.0 L/min.

6. Please refer to the dew point table for setting the cooling water temperature to prevent condensation on optical components.

Air		Relative Humidity																	
Temperature ℃	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
43	43	42	41	40	39	38	37	35	34	32	31	29	27	24	22	18	16	11	5
41	41	39	38	37	36	35	34	33	32	29	28	27	24	22	19	17	13	8	3
38	38	37	36	35	34	33	32	30	29	27	26	24	22	19	17	14	11	7	(
35	35	34	33	32	31	30	29	27	26	24	23	21	19	17	15	12	9	4	0
32	32	31	31	29	28	27	26	24	23	22	20	18	17	15	12	9	6	2	(
29	29	28	27	27	26	24	23	22	21	19	18	26	14	12	10	7	3	0	
27	27	26	25	24	23	22	21	19	18	17	15	13	12	10	7	4	2	0	
24	24	23	22	21	20	19	18	17	16	14	13	11	9	7	5	2	0		
21	21	20	19	18	17	16	15	14	13	12	10	8	7	4	3	0			
18	18	17	17	16	15	14	13	12	10	9	7	6	4	2	0				
16	16	14	14	13	12	11	10	9	7	6	5	3	2	0					
13	13	12	11	10	9	8	7	6	4	3	2	1	0						
10	10	9	8	7	7	6	4	3	2	1	0								
7	7	6	6	4	4	3	2	1	0										
4	4	4	3	2	1	0													
2	2	1	0	Sec					100										
0	0			20						0		e	1				e		

Table 3-1 Dew Point Temperature at Different Temperatures and Humidity Levels



Chapter 4 Electrical Interface



Figure 4-1 Bus system wiring diagram

Only the personnel who have received the training and possess the necessary expertise are permitted to perform the operations mentioned above. BCS210E shall be powered off when connected to the cutting head.

Waterproof cautions for PWE and aviation plug interfaces:

1. The PWE interface and aviation plug interface come with dust plugs at the factory, which can achieve a protection level of IP64 with the dust cap securely in place. At the same time, with the PWE cable and aviation plug line connected properly, the protection level of IP64 can also be achieved.

2. After the dust plug is removed, it cannot achieve the protection level of IP64. If it encounters spraying or flushing, it will cause water to ingress into the product, affecting its function.

3. Ensure that the waterway is properly connected and the water pipe interface is tightened before removing the dust plug to prevent the water pipe from accidentally loosening and causing water to



rush into the interface, resulting in water ingress into the product.

4. When adjusting the machine wiring, remove the dust plug for wiring, and it is recommended to keep the removed dust plug of the PWE interface. Install the dust plug immediately after removing the wire to prevent accidental water ingress during transportation, water connection, and other processes.

Chapter 5 Cutting Head Installation

During the installation of the cutting head, dust or dirt may accidentally enter the cutting head and contaminate the optical window, affecting its normal use. Please refer to the following installation instructions to avoid contamination.

5.1 **Preparations before Installation**

Prepare the items listed below:

- Cutting head.
- Clean workbench (Type of clean workbench: vertical purification; Cleanliness level: ISO 5, 100; Average airspeed: ≥ 0.4 m/s).
- Clean kit: high-intensity flashlight, anhydrous ethanol (or IPA), lint-free purification swabs, cleanroom wiper, compressed air dust removal can (or air blower).



Figure 5-1 Preparation tools for the cutting head installation

Caution:

1. Only the personnel who have received the training and possess the necessary expertise are permitted to perform the operations mentioned above.

2. To ensure the proper function of the laser equipment and the safety of the operators, please adhere to the relevant operating instructions.

5.2 Specific Procedures

5.2.1 Prepare the Clean Workbench

Prepare the clean workbench, and start it to work properly.



Figure 5-2 Clean workbench

- Step 1 Check the cleanliness of the equipment (use a particle counter to check cleanliness) and confirm that the Fan Filter Unit (FFU) is within its validity period (measure the average airflow speed in the work area; if the airflow speed is below 0.3 m/s, the FFU must be replaced).
- **Step 2** Check that all switches are functioning properly and verify that the fan is operating normally.
- Step 3 No unnecessary items should be installed in the clean workbench to prevent the clean airflow from being obstructed.
- Step 4 For newly installed or long-unused clean workbenches, clean the surface with the cleanroom wiper and anhydrous ethanol before use.



Startup Procedures:

- Step 1 Connect the power supply and slide the glass door of the clean workbench down to the lowest position, leaving a gap of approximately 10 cm.
- Step 2 Start the fan, and it is recommended to allow the workbench to purify for about 30 minutes before use.
- Step 3 After normal operation, turn on the clean workbench's lighting.

5.2.2 Put the Cutting Head inside the Clean Workbench

Put the cutting head horizontally inside the clean workbench.



Figure 5-3 Put the cutting head inside the workbench

Caution: To prevent dust from falling inside the chamber, please check the integrity of the specified protection film/cap for the fiber interface before inserting or removing the fiber optic cable.

5.2.3 Clean and Wipe the Fiber Optic Interface of the Cutting Head

Clean the fiber interface with the cleanroom wiper soaked in anhydrous ethanol.



Figure 5-4 Clean the interface

5.2.4 Check the Laser Fiber Optic Connector End Face

Remove the protective cap from the laser fiber optic connector. Use the high-intensity flashlight to inspect the fiber end face for contamination. If clean, the fiber can be directly inserted; if not clean, clean it with a swab dipped in anhydrous ethanol or IPA.

5.2.5 Remove the Protective Film / Remove the Protective Cap

Remove the dedicated protective cap or protective plug from the fiber optic connector on the cutting head.

5.2.6 Insert the Laser Fiber Connector into the Cutting Head

Align the fiber optic connector with the red reference line, insert it into the unlocked fiber optic connector, and ensure it is fully seated. Rotate the locking cap until it is tightly secured.



Figure 5-5 Insert the laser fiber connector

5.2.7 Wrap and Seal

After inserting the fiber, use the tape to wrap and seal the connection between the fiber and the interface of the cutting head.



Figure 5-6 Wrap and seal

Caution: To ensure a proper seal, it is recommended to wrap at least three layers of tape for sealing.

5.2.8 Install the Cutting Head on the Back Plate

The cutting head can be mounted onto the machine's Z-axis back plate using four screws: A, B, C, and D. When securing the cutting head to the machine, it is essential to ensure that the cutting head is properly tightened and free from any wobbling.



Figure 5-7 Screw A, B, C and D

5.2.9 Install Nozzle and Ceramic Body

Install the ceramic body and secure it with the locking ring, then install the nozzle.



Figure 5-8 Ceramic body and nozzle installation

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5.2.10 Laser Beam Centering

Adjust the X-Y alignment knobs using low-power pinpointing to ensure the focus is at the center of the nozzle.



Figure 5-9 Laser beam centering

Manual Operations for Beam Centering:

- **Step 1** Make sure the laser beam has been turned off.
- Step 2 Put the tape below the nozzle.
- Step 3 Click to trigger a low-power laser pulse and assess the position of the laser beam relative to the nozzle based on the penetration of the tape.
- **Step 4** Adjust the X/Y alignment screws to position the laser beam at the center of the nozzle.

5.2.11 Install Laser Clamping Unit

Attach the laser clamping unit to the cutting head with two screws: A and B.

Figure 5-10 Attach the laser clamping unit

Insert the laser connector through the clamping unit into the cutting head and secure it.



Figure 5-11 Insert the laser connector

(1) ВОСНИ

Chapter 6 Appendix A Maintenance

A.1 Product Structure Diagram



Figure 6-1 Product diagram



A.2 Replace the Upper Protective Window



Figure 6-2 Replace the 1st upper protective window

Follow the procedures below to replace the 1st upper protective window:

- Step 1 Turn the two screws of the 1st upper protective window cover counterclockwise to the unlocked position.
- Step 2 Pull out window cartridge.
- Step 3 Seal the cartridge with the masking tape to prevent dust from entering.
- **Step 4** Remove the pressing ring from the protective window.
- Step 5 Replace the upper protective window.
- **Step 6** Tear off the tape.
- Step 7 Insert the protective window cartridge with the new window into the cutting head.
- **Step 8** Tighten the two screws.



Figure 6-3 Insert the window cartridge



A.3 Replace the Lower Protective Window



Figure 6-4 Replace the lower protective window

Follow the procedures below to replace the 1st lower protective window:

- Step 1 Turn the 1st protective window cartridge locking screw counterclockwise to loosen.
- Step 2 Pull out the 1st lower protective window cartridge.
- Step 3 Close the lower protective window cartridge cover to prevent dust from entering.
- **Step 4** Remove the pressing ring from the protective window.
- Step 5 Replace the lower protective window. Place the pressing ring and tighten it.
- **Step 6** Remove the masking tape.
- Step 7 Insert the 1st protective window cartridge into the cutting head.
- **Step 8** Tighten the two screws.

Chapter 7 Appendix B Mechanical Dimensions

B.1 Cutting Head Installation Size



Figure 7-1 BLT510-150J



Figure 7-2 BLT510-200J



Figure 7-3 BLT510-250J



B.2 Interface Types

General Type	Image	Other Compatible Interface Types
QBH	QBH	 Trumpf LLK-Q IPG HLC-8 / LC-8
EOC		• Maxphotonics G5

Table 7-1 Interface Types of BLT510

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